

Strategies in Management of Tibial Plateau Fractures

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Abstract:

Background: Advancement in technology and acceleration in automobile development have been accompanied by increase in number and severity of fractures and those of tibial plateau are no exception. Being one of the major weight bearing joints of the body, fractures around it are of paramount importance. The study was aimed to identify the strategies in surgical treatment of tibial plateau fractures, its functional outcome and complications.

Methods: Thirty-two cases of tibial plateau fractures treated and studied from Jan 2015 to Dec 2017 and followed up for a minimum period of 6 months and maximum of 2 yrs.

Results: The selected patients evaluated thoroughly: clinically and radiologically, were taken for surgery, after the relevant lab investigations. The indicated fractures were treated as per the Schatzker's types accordingly with ORIF with buttress plate with or without bone grafting with respect to the condition of the skin which decided our timing of surgery and the method of internal fixation. Early range of motion started soon after the surgery. No weight bearing upto 6-8 weeks. The full weight bearing deferred until 12 weeks or complete fracture union. Immobilization in insecurely fixed fractures continued for 3-6 weeks by POP cast. The knee range of motion was excellent to very good, gait and weight bearing after complete union was satisfactory. We found loss of tibial plateau contour by redepression in 1 case, knee stiffness in 3, wound dehiscence in 2 cases and non-union in none of our cases.

Conclusion: Surgical management of tibial plateau fractures will give excellent anatomical reduction and rigid fixation to restore articular congruity, facilitate early motion and reducing post-traumatic osteoarthritis and hence to achieve optimal knee function. However soft tissue condition dictates the method and timing of the surgical management.

Keywords: Fracture, Tibial plateau, Buttress plate, Bone graft

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I. Introduction:

Tibial plateau fractures are one of the commonest intra-articular fractures resulting from indirect coronal or direct axial compressive forces. Fractures of tibial plateau constitute 1% of all fractures and 8% fractures in the elderly [1]. These fractures encompass many and varied fracture configurations that involve the medial condyle (10-23%), lateral condyle (55-70%) or both (11-30%) with differing degrees of articular depression and displacement. In case of improper restoration of the plateau surface and the axis of the leg, these fractures could lead to development of premature osteoarthritis, injury in ligaments, as well lifelong pain and disability [2]. Tibial plateau fractures may be accompanied by meniscal and ligamentous injuries to the knee too [3].

For assessment of the initial injury, planning management and prediction of prognosis, orthopedic surgeons widely use the Schatzker classification system, which divides tibial plateau fractures into six types. Each increasing numeric category specifies increased level of energy imparted to bone thereby increasing severity of fracture [3]. First four are unicondylar and type V and VI are bicondylar. Each fracture's pattern in Schatzker classification helps to direct orthopedic surgeons to adopt appropriate treatment modality [4].

The timing of the surgery is determined by the condition of the skin and the soft tissue. The method of internal fixation like bicolumn plating or unicolumn plating with screw fixation for other column were all determined based on the condition of the skin around the fracture areas which permit either MIPPO fixation or Open Fixation with proximal tibial locking compression plates.

The aim was to study on the treatment strategies in the surgical management of intra-articular fractures of proximal tibia is to obtain a stable, pain-free, mobile joint, to prevent the development of osteoarthritis and to correlate the radiological findings with the type of fracture and the functional end result of management.

II. Materials & Methods:

The cases studied were included for study during January 2015 to December 2017 who came as inpatients to our institute with proximal tibial fractures. Total 32 cases were studied. The average age of patient was 41 years with the oldest patient 60 years and youngest 24 years.

Inclusion Criteria

- a) Age: Patients above 18 years of either sex.
- b) Radiological diagnosis of fractures with classification based on Schatzker's classification.

Exclusion Criteria

- a) Age: Less than 18 years.
- b) Patients who are medically unfit for the surgery.
- c) Compound tibial plateau fracture.

The major determinant in the decision of the timing of surgery is the skin condition. In most of our cases there was soft tissue oedema and contusion associated with the tibial plateau fractures which made us to wait for about a week for the oedema to settle and skin to show some wrinkling to plan the further line of management. In case which were operated without any attention to skin condition resulted in loss of the soft tissue coverage in the form of infection or tissue necrosis. Compartment syndrome being more prevalent in the proximal tibial fractures we serially monitored it on the initial waiting period prior to surgery and after surgery to prevent any complications pertaining to it.

Whenever rigid internal fixation was achieved, the patient was mobilised 48 hours after removal of the drains, for 2-5 days the range of motion allowed was 0-20°, from the 5th day the range of motion was gradually allowed to be increased to 90° or more. After suture removal, full range of movement was allowed.

Whenever there was doubt about the rigidity of fixation, external splinting in the form of plaster of paris slab was given for support. Range of motion exercises (CPM) were done daily under careful supervision and splint reapplied. All the patients were taught and advised to do static quadriceps exercises and dynamic exercises with a quadriceps board as much as possible and throughout the day. Partial weight bearing was delayed until 6-8 weeks and full weight bearing allowed after 12-16 weeks. The best time for open reduction and internal fixation was within 4 hours of injury or 1 week after the injury, when the swelling and the inflammatory reactions have subsided.

III. Results:

Observation and analysis of results was done in relationship to age, type of fracture, method of treatment, duration of immobilization, complications and the remarks of different age groups. None of the patients were immobilized when secure, rigid fixation was done. In case of doubt about rigidity of fixation, associated ligament injury or osteoporosis, the immobilization was extended preferably in above knee cast upto 3 weeks. Two cases of infection and another case of severe metaphyseal comminution had to be immobilized for 6-8 weeks. Most of the cases had good range of painless knee motion (0-130°), except for the last group where one patient developed knee stiffness.

All fractures united within expected time. Not a single case of non-union was noted in given series. Average time for union was 14 weeks (range 10-22 weeks). Out of 32 cases treated with surgical procedure, 14 cases gave excellent result and 2 cases of poor result were seen, mainly due to the severity of the injury and infections. Retrospectively it was found that high velocity injuries with associated soft tissue damage (Type IV – VI) have poorer outcome than low velocity injuries (Type I-III)



Figure showing the various strategies followed in management of Tibial Plateau fractures
 Row 1 shows the management of Tibial Plateau fracture by Unicolumn Proximal Tibial LCP
 Row 2 shows the management with Bicolumn Plating of Proximal Tibia while Row 3 shows
 the management of highly comminuted tibial plateau with Bicolumn LCP and Bone grafting.

IV. Discussion:

Tibial plateau fractures, one of the commonest intra-articular fractures, are major traumatic injury occurring as a result of RTA, fall from height, violence etc. It is sometimes associated with other bony or soft tissue injuries. Any fracture around the joint (especially weight bearing knee joint in the lower limb) is of

paramount importance as it results in significant morbidity and adversely affects quality of life. Hence, the treatment of upper tibial fractures with intra-articular extension is a challenge for the orthopedic surgeons.

In present study, the majority of fractures occurred between the age of 20 and 60 years with maximum incidence in the productive age group of 31-40 years (50.25%). Honkonen SE [6] also showed age incidence 20-60 years with an average of 39.8 years which correlates with the present study. Lee et al., [7] too showed that the average age of tibial plateau fractures in patients was 42 years. Albuquerque et al., observed that 71% of injuries occurred in those aged 30-60 years, with maximum frequency between 40-49 years [8]. High energy injuries are more common in youngsters and low energy fractures in elderly patients [4].

The tibial plateau fractures are commonly seen in the active and productive age group especially in male patients as they engage in more activities and travels. In given study males were more affected than females which was also reported by Lee et al., (65.71%) [7], Albuquerque et al., (70.3%) [8], Manidakiset al., (58.4%) [9] and Mehin et al., (56%) [10].

In given series, Schatzkar Type I and Type II dominated the total fractures making 50%. Similarly Rademakers et al., reported that 64% patients sustained a fracture of the lateral condyle (Schatzker 1/2/3) [11]. Mehin and coworkers reported about 30% of the injuries were high-grade Type-VI tibia plateau fractures, whereas 35% were lower-grade Type-III fractures [10]. In MRI analysis of 103 patients, Gardner et al., reported that the most frequent fracture pattern was a lateral plateau split-depression (Schatzker II) [12].

In this series we studied 32 cases of simple tibial plateau fractures treated only by surgical methods. Different authors use different criteria for the surgical management of these fractures. In present study, 3mm depression was considered as an indication for surgery. Schatzkar [13], reported 70 cases of tibial plateau fractures of all types treated by conservative (56%) and surgical (44%) with average follow-up of 28 months. Acceptable results were obtained in 58% of cases of conservative group and 78% by open methods.

In the early half of the 20th century an author reported two studies having satisfactory percentage of good to excellent short and long term results with surgical method of treatment [14,15]. Another published study of 159 cases of tibial plateau fracture of all types reported better "good-excellent" results in surgery (84%) than conservative (62%) methods [16]. Mehin and coworkers reported that "of 286 patients with tibial plateau fractures, of whom 77% were treated operatively" [10]. Similarly Pasa et al., too reported that 30% were treated conservatively and 70% by a surgical procedure [17].

We have not formulated the stringent criteria as to particular method of fixation for particular type of fracture. So each case was individualized and treated accordingly as it needs. Major treatment strategy is in achieving excellent anatomical reduction to prevent early osteoarthritic changes in the knee. Prevention of local complication can be achieved by respecting the soft tissue around the injury and considering optimal management options keeping soft tissues also in mind along with fracture pattern.

Most of the type I, some Type II and a case of Type V were treated either with percutaneous cancellous screws or buttress plating depending on the skin condition. The split fracture, of >3mm displacement was treated by ORIF. Bone grafting was included along with ORIF with locking compression plating and screws in Type II, III, V and VI wherever necessary. Of 114 patients with proximal tibial fractures, Pasa et al., used fixation with a cancellous screw and washer in 25, and a buttress plate in 27 patients. They also reported that better results were achieved in treatment of Intra-articular fractures of the proximal tibia by minimally invasive fixation with cancellous screws [17]. Hence we supported the column not amenable to plate fixation due to soft tissue reasons with cancellous screw fixation.

The major determinant in the decision of the timing of surgery is the skin condition. In most of our cases there was soft tissue oedema and contusion associated with the tibial plateau fractures which made us to wait for about a week for the oedema to settle and skin to show some wrinkling to plan the further line of management. In case which were operated without any attention to skin condition resulted in loss of the soft tissue coverage in the form of infection or tissue necrosis.

The benefits of early knee motion include - reduce knee stiffness and improved cartilage healing (regeneration). However, these benefits are to be cautiously balanced by risks, including loss of fracture reduction, failure of internal fixation and compromised ligament and soft tissue healing. Schatzker et al., stated that the prognosis is given by the degree of displacement, type of fracture, method of treatment and quality of postoperative care [13].

We achieved 64% excellent result 24% good results (overall 88% acceptable results) with our standard surgical care using standard fixation methods. In addition we had 12% fair results in terms of functional outcome. These results are comparable and on par with other documented standard studies.

V. Conclusion:

Tibial plateau fractures are increasing (especially the high velocity injuries) with the increase in automobile accidents. Surgical treatment when indicated (particularly in depressed and displaced fractures) is advantageous to get a stable knee. The strategies of surgical management of tibial plateau fractures is mainly in

achieving a good anatomical reduction & rigid fixation to restore articular congruity, with respect to the soft tissue condition to facilitate early knee motion by reducing post-traumatic osteoarthritis and thus achieving optimal knee function.

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Competing Interest:

The authors declare that they have no competing interests.

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